Creativity in the Design Curriculum

Brad Hokanson
University of Minnesota
MN, USA

Abstract
This paper presents the results of empirical research from a university class for design students in creative problem solving. A small group of students received training in creativity and are compared with a larger group of design students who did not. Measured creativity of the treatment group significantly increased, apparently as a result of the class. This paper argues that creativity may require specific training to develop; at the very least, training is valuable in developing creativity in early design students. The nature of creativity and the structure of the class are described, followed by an outline of the research methodology and the use of the verbal Torrance Test of Creative Thinking.

Within our understanding of visual literacy, the way we invent new ideas – creativity – is highly revered; visual professions such as graphic design, painting, and architecture all note the value of creativity and seek to encourage its development. We expect a connection between visual capabilities and creativity, and that raises the question: Does creativity spring from work in the visual fields? While creativity is applied without conscious attention at a multitude of scales, from buildings to jewelry, it also may require specific attention in our educational programs, including those in design.

Improving creativity can be done in a number of ways and by a number of methods. There is a wide variety of books and techniques to help develop one’s creativity, but most research indicates that creativity as a human trait is not summarizable into a simple technique, trick, or method, and that the trait of creativity is complex and comparable to analytical thinking (Martin, 2007). Short term gains in creativity are possible through the use of various methods, but true development of creative skill occurs through extended effort.
Ironically, within the visual and creative fields, creativity is seldom a dedicated topic of instruction. In these areas, it is assumed that work in the studio alone, as painter, designer, or architect, will develop one’s creativity. This is part of a larger condition in education where thinking skills are generally not directly taught as much as other pragmatic applied abilities such as writing, drawing, computer use, or research methods.

The creativity that is examined here is not the generative and diligent thought of the inventor or painter, but rather the atomic level ability to rapidly develop new, divergent, and applicable ideas. This skill is the focus of the Torrance Tests of Creative Thinking, a set of widely used standardized exams.

This writing will discuss definitions of creativity as contrasted with intelligence and innovation, the participants in the study, the methods of instruction, and the methods and results of testing, concluding with a brief examination of implications for education in design and the visual fields.

**Creativity, Innovation, and Intelligence**

We can see creativity in the recognized genius of da Vinci or Beethoven, but creativity is also present in most people, at varying levels, and that is the focus of this study. Specifically, this study examines creativity as a cognitive and generative ability, attempting to know how people have new ideas. According to Cox (2005, p. 8), “Creativity is the generation of new ideas—either new ways of looking at existing problems or of seeing new opportunities…”

Robert Hughes (1981) outlined a leading role for art in his book The Shock of the New, one of exploring and serving as a vanguard for thought in modern society. It resounds here, implying a primacy of the visual arts in terms of creativity. The visual arts do not, however, have a monopoly on the need for creative ability. Whether creativity is solely or primarily a visual skill is matter of conjecture; those in non-visual fields might argue that it is not. Creativity in any field is the capability and aptitude to generate the new.

Creativity does have an importance beyond the visual arts or design fields, and it is increasingly viewed as critical in such areas as education and business. Popular books such as The Rise of the Creative Class by Richard Florida (2004) and The World is Flat by Thomas Friedman (2005) argue for the value of creativity. Businesses and corporations often hope to support and encourage creativity in their workers in order to develop new products or more effective means of production. The Danish toy company Lego seeks to develop new and innovative toys to retain economic health, which also will support economic strength of Denmark (Nielsen, 2004). The United Kingdom’s vision
of a creative and innovative society is inherent in the Cox Report (2005), and the government of the People’s Republic of China encourages the development of creative talents (Tischler, 2006).

This acceptance and adoption of new or novel ideas is generally termed innovation. Innovation is concerned with changing society, while creativity is the initial idea that sparks innovation (Rogers, 1991). Cox (2005), in his advocacy of the importance of creativity to the business and economic health of the country, said, “‘Innovation’ is the successful exploitation of new ideas. It is the process that carries them through to new products, new services, new ways of running the business or even new ways of doing business” (p. 8).

We also should note that creativity is different from intelligence in spite of frequent connections between the two. (Torrance’s initial work was with gifted and talented children, those that are most intelligent, and their abilities in terms of creativity.) An inclusive definition of intelligence may include creativity as one aspect, but most researchers and theorists in the creativity field consider it distinct from intelligence. While there is some correspondence between processing, remembering, and applying information – the most common measurement of intelligence, and the development of new ideas, intelligence and creativity are generally independent of each other (Rumco, 1995).

Many studies recognize creativity as a cognitive ability separate from other mental functions and particularly independent from the complex of abilities grouped under the word “intelligence.” Although intelligence—the ability to deal with or process large amounts of data—favors creative potential, it is not synonymous with creativity (Preti & Miotto, 1997, p. 2).

**Teaching Creativity**

Increasing creativity is the focus of many efforts in education and business. Although these efforts are not limited to courses or training activity, they do prove to be capable of increasing creative output (Montuori, 1992). Educational methods to increase creativity include cognitive, personal, motivational, and social approaches (Bull, Montgomery, & Baloche, 1995).

Scott, Leritz, & Mumford (2004) conducted a meta-analysis of 70 studies evaluating creativity training and found a number of factors that affected success. Instruction in structured techniques, such as formal brainstorming, was more successful than courses using unconstrained exploration or expression as a means to develop creative talent. The most significant changes occurred through the use of techniques such as critical thinking, convergent thinking, and constraint identification. A consistent element in most creativity classes or training is “divergent thinking,” the development of multiple answers to stimuli, increasing the capacity to provide more than one answer to a problem.
or question. This would hint that specific training and dedicated courses were important to curricula in the arts or design.

**Method**

**The Research Venue**

A small course on creative problem solving was the principal research locus. The course blended active learning with instruction in creativity theory. Aspects of the course included repeated practice at rapidly generating multiple ideas, weekly student-directed personal activities, coursework on methods and theories of creativity, and a series of creative and collaborative activities. The student-directed activities were a series of “do something different” ranging from eating something different, wearing something different, or experiencing different routes in their everyday lives. These activities were designed to be a public acknowledgement of their own creativity; each activity was presented to the class.

The course was organized around accepted methods of teaching creativity as noted in Fasko (2001), as well as the supportive research of Scott et al. (2004). These methods included development of organizational skills, practice in idea generation, collaborative activity, student-directed learning, and the application of ideas.

**Measurement**

Given the wide range of definitions of creativity, and evidence that creativity varies as well, methods of evaluating and measuring creativity also are diverse. Plucker & Renzulli (2002) examine a variety of research directions and note that a majority of research is based on “psychometric methods,” the “direct measurement of creativity and/or its perceived correlates in individuals” (p. 35).

The most common definition of creativity is the ability to produce a large number of ideas that address a given problem or stimulus. It also implies developing different types of ideas, and ideas that are unexpected or uncommon. Dr. Paul Torrance categorized these aspects as fluency, flexibility, and originality, and used these aspects as the structure for his tests of creativity. The Torrance Tests of Creative Thinking (TTCT) are the most widely used standardized tests of creativity and are used internationally (Plucker & Renzulli, 1999, p. 39).

This method of testing is only one measure of creativity within a broad spectrum, but it provides an insight into some aspects of creative abilities. It examines one aspect of creativity using verbal responses as it appears in the general population. Pragmatically, the TTCT is moderately easy and quick to administer, and can be scored by the publisher or the researcher.
The Torrance tests are available in both figurative and verbal form. For this research the verbal tests were used. Drawing or figurative tests may indicate different results, particularly with a visually oriented audience. This is a direction for future research, although writings by Torrance indicate that creativity measurements from the two forms are directly comparable.

Previous research also indicates that those skilled in the visual fields often use verbal clues or dialogs to codify ideas prior to development in visual form (Hokanson, 2001). Many in the creative and visual fields switch back and forth between different media, often between text and visual elements, as part of their creative work. For the generation of new ideas, words appear to be a frequent tool at recording ideas with rapidity. More developed and complex ideas may be advanced through specific media, such as oil painting, but the Torrance Tests measure the rapid generation of diverse ideas. Creativity, especially under time duress, encourages people to work using the most effective tools, visual or verbal, that they have at hand.

This study measures, of course, only one type of creativity: rapid, on-demand production of ideas. It does not measure the patient, persistent, logical creativity of advanced work with a consistent idea. In drawing terms, it is a gesture instead of an extended study.

**Elements of the Torrance Tests of Creative Thinking**

The written form of the Torrance Tests of Creative Thinking, which was used for this study has six sections asking for written responses to illustrations and verbal prompts. Each section is limited in the time a participant can develop answers. The written test has two forms designed for use before and after treatment. There are three measured aspects to the test: fluency, frequency, and originality.

The first thing one notices about creative people is their ability to develop a large number of new ideas. Fluency, as used in the Torrance Tests, is the capability to develop a large number of relevant responses to any query. The tests pose a series of questions, and participants are evaluated in part by the number of relevant responses. For example, one could be asked what one could eat, and such possibilities as macaroni, pizza, and hamburger would be expected. Each of these answers would count as applicable.

Flexibility is the ability to develop a wide range of divergent answers. Creative people are seen to seek answers that have more than slight differences and to generate categorically different answers from those previously developed. Creatives, as demonstrated by their flexibility, develop categorically different types of answers. For example, when asked what one could eat, participants could respond with answers such as food from a different culture or something not normally considered food but that is still edible, such as grass. However,
in this category, naming a sequence of foods from different cultures would not be sufficiently different.

Originality, the third metric, is the ability to diverge from the expected answers. Responses are compared with a set of common answers to the same problem. Here creativity is understood to mean seeking answers that are unexpected in societal context. For example, to eat something different would also include eating one’s own words or foot, which would not be common responses.

The Study

A pilot test in a previous creative problem solving course for first year students demonstrated strong gains in measured creativity through the Torrance Test. While the improvement in measured creativity could have been a result of the new experiences of college students or intensive design studio work, it was hypothesized that the course caused the gains in creativity. Hence, the following year a quasi experimental study was posed to compare the gains in creativity among students in the course with those of a broader population of design students.

The Torrance Test was administered to a large lecture course called Introduction to Design Thinking that had a concurrent enrollment by nine students from the creative problem solving class. In this way, the larger lecture course could serve as a control for the creative treatment.

This course is required of all entering design students at the university and includes presentations, readings, and elementary design problems. Students were design majors from interior design, clothing design, and graphic design. As part of their curriculum, each design student also completes courses in drawing, color theory, and an introduction to their discipline. The large lecture course is open to the rest of the university as well.

Ninety-five students took both forms of the verbal Torrance Tests as part of their course, and only first year design students were scored as part of this research. This included 60 first-year students (53 women and 7 men) with varying levels of college credit. Of these, nine women were also registered for the creative problem solving class. All of the participants from the creative problem solving class were honors students. Scholastic Testing, the publisher, scored all of the tests that were evaluated.

Results

The treatment group, those students enrolled in the creative problem solving class, showed significant gains in measured aspects of creativity in all three areas. The control group, the remaining students in the larger lecture

Journal of Visual Literacy, Volume 26, Number 1
class, showed slight but non-significant gains in two areas and had a significant gain for the originality metric.

**Fluency**

The mean raw score (total number of answers on task) of the treatment group increased by 34.4%; all members of the treatment group increased their score for measured fluency. These changes were statistically significant at 0.05. The standardized score increased from 109 to 122. For the standardized scores, 100 is considered average, and the standard deviation is 10. (See Table 1.)

Concurrently, measured fluency for students in the control group did not increase significantly. Their score increased by 2.5%.

Glass’ Delta was calculated for each area of the Torrance Test to determine effect size. This is calculated by dividing the difference between the means of the control and treatment groups by the standard deviation of the control group and provides a statistical way to understand how much of the change is attributable to various elements.

Results from the testing were compared with a meta-analysis of creativity training programs as published by Scott et al. (2004) and the effect size of 70 different studies was calculated by the Glass’ Delta method. They found a mean effect size of .70 for all combined instruction methodologies and a mean of .75 for divergent thinking methods, with a standard deviation of .67.

**Table 1**

*Fluency Scores and Comparisons; Effect Size*

<table>
<thead>
<tr>
<th>Group</th>
<th>Fluency RS – A mean</th>
<th>Fluency SS – A</th>
<th>Fluency RS – B mean</th>
<th>Fluency SS – B</th>
<th>Difference</th>
<th>T-test A:B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>94.67 [26.81]</td>
<td>109</td>
<td>125.44 [33.73]</td>
<td>122</td>
<td>134.41%</td>
<td>0.00047*</td>
</tr>
<tr>
<td>Control</td>
<td>88.40 [27.08]</td>
<td>106</td>
<td>90.56 [33.04]</td>
<td>105</td>
<td>102.45%</td>
<td>0.49</td>
</tr>
<tr>
<td>T v.C T-test</td>
<td>0.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0020*</td>
</tr>
<tr>
<td>Glass’ Delta</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.056</td>
</tr>
<tr>
<td>Control Delta</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.065</td>
</tr>
</tbody>
</table>

RS = raw score. SD = standard deviation. * = significant at .05
SS- Standardized Score: mean 100, SD 10.
The effect size for this class was calculated at 1.06 for fluency, which is higher than but comparable to the mean. It is approximately .42SD above the mean, well within an expected distribution of results.

**Flexibility**

For the creativity class participants, scores on flexibility (the measure of divergent responses to questions) were found to have significantly improved. The mean of the treatment group increased by 35.3%. The increase was significant at 0.05. In contrast, the control group score for flexibility increased by 2.9%, but that change was not significant. (See Table 2).

Standardized scores for the treatment group also increased by over one standard deviation. The standardized score for the control group declined slightly in spite of an increase in raw score due to differences between the two forms of the verbal Torrance Test.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Flexibility Scores and Comparisons; Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Flex. RS – A mean</td>
</tr>
<tr>
<td>Treatment n=9 [SD]</td>
<td>48.33 [10.84]</td>
</tr>
<tr>
<td>Control [n=51] [SD]</td>
<td>49.40 [11.16]</td>
</tr>
<tr>
<td>Treatment v. Control T-test</td>
<td>0.61</td>
</tr>
<tr>
<td>Glass’ Delta T - C</td>
<td>1.022</td>
</tr>
<tr>
<td>Glass’ Delta Control A-B</td>
<td>0.056</td>
</tr>
</tbody>
</table>

RS = raw score. SD = standard deviation. * = significant at .05
SS = Standardized Score: mean 100, SD 10.
**Originality**

The treatment group demonstrated a 55.2% increase in originality as measured by the TTCT. This metric is the development of ideas that are new and uncommon in society at large, as previously presented by participants in the Torrance Tests. Surprisingly, the control group also significantly increased their originality scores by 16.3%. (See table 3.)

While the control group demonstrated an increase in originality raw score, this was in contrast to scores in Fluency and Flexibility. Apparently, while the same number of ideas were developed by control participants, their ideas were more divergent than among society as a whole. In other words, while the students did not have more new ideas, those they had were more diverse after their initial college and design experience.

Glass’ Delta was calculated for both treatment and control groups for the originality metric; the treatment group effect size was 1.21 and the control group effect size was .262. In other words, about 25% of the increase in originality was due to the common activities of the larger class, while the remainder was due to the creativity treatment.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>66.00 [23.41]</td>
<td>116</td>
<td>98.56 [31.87]</td>
<td>124</td>
<td>155.20%</td>
<td>0.00052*</td>
</tr>
<tr>
<td>Control</td>
<td>59.19 [22.73]</td>
<td>111</td>
<td>66.16 [26.60]</td>
<td>108</td>
<td>116.35%</td>
<td>0.017*</td>
</tr>
<tr>
<td>Treatment v. Control T-test</td>
<td>0.80</td>
<td>0.0020*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass’ Delta T - C</td>
<td></td>
<td>1.218</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass’ Delta Control A-B</td>
<td></td>
<td>0.262</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RS = raw score. SD = standard deviation. * = significant at .05
SS = Standardized Score: mean 100, SD 10.
The treatment group was compared to the control group for both forms of the test using a non-paired t-test. While before treatment the groups were not significantly different, after treatment, in spite of significant gains by the control group, a difference was found.

**Discussion**

This study indicates that creativity can be developed through instruction in a course setting; the findings are consistent with a number of studies both in terms of scale of change and details of instruction (Scott et al., 2004).

Results from both the pilot and the control group show significant gains in the aspects of creativity that were measured. The nature of the course, with a range of teaching methods and a long term approach, encouraged the development of creativity.

The creative problem solving students had self-selected the course and may have had a higher propensity toward creativity. The creativity course students also were higher achieving students, and this may have been an advantage, as Torrance (1972) indicates there is a correlation between creativity and intelligence.

Creativity exists within a context, and investigation of creativity must seek to understand the environment surrounding its practice. These observations also shine some light on the effect of creative context. Design classes and the novelty of the college experience do not, in themselves, develop creativity in students, at least over the short time of 15 weeks. Most measures of creativity did not significantly change for the control group. Given that those receiving instruction demonstrated gains in measured creativity indicates a value to that instruction.

**Implications for Education**

Instruction in creativity in a distinct course appears to be effective in advancing creativity in design students. Design students in the same context do not develop creativity skills at the same rate as design students receiving specific training in creativity.

Within the curricula of any visual field, separate courses may be necessary for the full development of creative skills. While many techniques of creativity are built into design courses as part of our learned procedures, that may not be enough to significantly change creative behavior. Specific concentration on creativity may need to be formally identified and taught. Additionally, knowledge in a domain, whether design, art, or business is not sufficient to increase creativity, but it may be a catalytic medium for creative output.
Directions for Further Research

As with any research, new questions are raised by the findings. Principal among them is whether students in the visual fields develop their creative abilities without the benefit of a specific class to address creativity, or whether their perceived improvements in creativity are due to their educationally based skills improvement. After a professional education, are designers really more creative or are they just more skilled in their field?

The participants in the study were first year students in three areas of design: clothing, graphic, and interior design. As such they also would be expected to be more visually oriented and their response to the figural Torrance Test could be quite different from verbal test results. This is a potential area for future research. Would there be a difference in creative ability as measured by the two forms of the Torrance Tests? Would skilled designers or design students, with heightened skills in visual literacy, have a higher measured level of creativity on a visually based test?

It is important to understand how creativity is learned and developed in design education and throughout the visual fields. Creativity is inherently valued by those in design, and recognized as an essential part of visual literacy. This study suggests that coursework in creativity is valuable for education in design and visual fields.

References


